MINER & SMITH

Different Methods for Feeding Swine

Agriculture
B S
1906

DIFFERENT METHODS
for
FEEDING SWINE

by

Alfred Glaze Smith
and
J Howard Miner

Thesis for the degree of Bachelor of Science in Agriculture

in the

College of Agriculture

of the

University of Illinois

June 1906.

UNIVERSITY OF ILLINOIS

June 7 1906

THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

Alfred Glaze Smith

ENTITLED Different Methods for Feeding Swine

IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE

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Herbert W. Mumford

HEAD OF DEPARTMENT OF Animal Husbandry

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INTRODUCTION.

The pork producing industry in Illinois has come to be of gigantic proportions, and the methods practiced and the cost of production are subjects worthy of deepest investigations. The common method of feeding hogs throughout the corn belt of Illinois is to allow them to run on some kind of pasture during the summer, feeding only a slight amount of corn and then fattening for the market with only a corn and water ration after grass is gone.

OBJECT.

It was for the purpose of determining the comparative value of this common method and at the same time of devising a better one that this experiment was planned and carried through. Three methods of feeding with similar lots of pigs, the first fed in the ordinary way, the second fed a mixed ration of corn meal, bran, middlings and tankage so that the digestible nutrients, compounded according to the method by which the best results were obtained at the Illinois Experiment Station, were in proportion to the live weight and the third fed similar to the second excepting that the pigs were fed in individual stalls.

PLAN.

For the purpose of the determination twenty-one pigs four months old, from four litters, three of Berkshire and one of Duroc Jersey, were divided into three lots of seven each, in such a way as to make each lot similar to the others. The pigs of one litter were distributed equally as far as possible among

the three pens. Likewise they were divided according to number of barrows and sows and to the size of the pigs. So when the division was completed, the different litters and the barrows and the sows were as nearly equally represented in each lot as possible. As to size also the pigs were so distributed that the total weight of each lot was practically the same, viz.- Lot I,523.5#. Lot II, 520.5# and Lot III, 524#.

Previous to the experiment all the pigs had been fed the same, the ration consisting of corn meal, bran, middlings and a small amount of tankage. All had had an equal chance and there was practically no difference in the three lots at the beginning of the experiment to affect the results.

Each lot was placed in a pen, about a quarter of an acre in extent, with a cot for shelter. At the back of the pen containing Lot I, an opening was made so that the pigs could run on a small strip of blue grass and clover pasture. At the end of a month, however, this was exhausted and the pigs were confined in the pen as were the others. A trough was placed in each pen and in this at regular intervals, as it was consumed, charcoal, bonemeal, ashes and salt were placed but the amount was so small and the cost so insignificant that, although they acted as a tonic for the hogs, they were not taken into consideration in the final results. The pigs were bedded with corn stover, and watered in a trough, the water being carried to them twice daily from a hydrant. Every Saturday morning before feeding they were weighed on a pair of Fairbanks scales. Lot III was weighed collectively and individually. Lot I and

II were each weighed, collectively. The feed was calculated upon the estimated weight of the week following.

As was previously stated Lot I was fed according to the common practice in the corn belt of Illinois, that is, corn and grass as long as the grass lasted and then corn alone. The corn was fed in the ear and was thrown on a board floor on the ground.

Lot II was fed a mixed ration of corn meal, bran, middlings and tankage, the amount being based upon the estimated weight of the hogs for the week following. The feed was given them in an open trough so that it was accessible to the whole lot together at the same time.

In Lot III each pig was fed separately in a separate trough. The feed was similar to that of Lot II only each individual pig was fed according to its weight. The amount for each pig was determined by taking the total weight of the lot then the weights of each individual and then calculating each pig's share of the total feed. Thus each pig received its allotted amount.

To feed the pigs in the lot separately, seven stalls were made side by side, on the feeding floor, and the feeding trough, located at the head of the stalls, divided into seven parts so that each pig really had a separate trough. The stalls were four feet long, three feet high and eighteen inches wide. A drop gate was fixed behind each so that when the animal was in the stall, it could not get out until the gate was raised. The pigs were soon taught to come into the proper

stall when the gates were raised for feeding but they were allowed to run together in the lots except at feeding time.

EXPERIMENTAL DATA.

The following tables give the data of the experiment, and the charts which represent different subjects show the comparisons between the three lots.

Lot I.

Weekly Weights.

No. of Wk.	Date.	Live Weight.	Weight of Feed	Gains.
			Corn.	
	Oct. 21	523.5		
1	" 28	544.	161.6	20.50
2	Nov. 4	575.	191.2	31.
3	" 11	580.	122.4	5.
4	" 18	618.	168.	38.
5	" 25	640	159.8	22.
6	Dec. 2	662.	156.8	22.
7	" 9	700.	170.4	38.
8	" 16	740.	185.6	40.
9	" 23	790	194.4	50.
10	" 30	822.	210.4	32.
11	Jan. 6	832.	173.6	10.
12	" 13	852.	147.6	20.
13	" 20	902.	162.4	50.
14	" 27	920.	181.6	18.
15	Feb. 3	934.	163.2	14.
16	" 10	960.	168.8	26.
	Total		1817.8	436.5

Lot II.

Weekly Weights.

No. of Wk.	Date	Live Wt.	Gains	Weight of Feed. Corn Meal	Bran	Middlings	Tankage
	Oct. 21	520.5					
1	" 28	550.	29.5	30.5	88.2	17.4	6.8
2	Nov. 4	584.	34.	40.7	99.8	27.7	7.7
3	" 11	618.	34.	45.1	105.7	38.7	7.7
4	" 18	658.	40.	50.3	113.6	51.6	7.7
5	" 25	696.	38.	53.8	124.6	55.3	7.7
6	Dec. 2	732.	36.	57.4	133.7	58.8	7.7
7	" 9	800.	68.	69.4	122.4	68.1	9.3
8	" 16	850.	50.	86.8	96.2	84.4	9.1
9	" 23	928.	78.	115.4	56.	106.2	16.2
10	" 30	988.	60.	158.1	40.5	91.7	23.
11	Jan. 6	1074.	86.	235.3	15.5	55.3	33.2
12	" 13	1142.	68.	300.7		20.3	50.1
13	" 20	1200.	58.	290.7			8.
14	" 27	1250.	50.	350.			
15	Feb. 3	1298.	48.	330.			
16	" 10	1360.	62.	350.			
Total			839.5	2564.5	996.2	675.5	194.2

Lot III.

Weekly Weights.

No. of Wk.	Date	Live Wt.	Gains	Weight of Feed.			
				Corn Meal	Bran	Middlings	Tankage
	Oct. 21	524.					
1	" 28	544.	20.	34.1	88.	19.4	6.5
2	Nov. 4	583.	39.	40.6	101.6	27.5	7.3
3	" 11	610.	27.	45.1	105.8	37.7	7.7
4	" 18	670.	60.	53.2	98.	55.7	8.9
5	" 25	712.	42.	62.8	91.6	68.1	10.7
6	Dec. 2	756.	44.	66.5	105.4	70.7	10.5
7	" 9	833.	77.	77.3	94.4	80.4	13.3
8	" 16	911.	78.	96.8	72.2	103.4	17.5
9	" 23	962.	51.	134.6	39.6	114.8	25.2
10	" 30	1021.	59.	177.5	29.	91.3	32.1
11	Jan. 6	1094.	73.	231.1	12.5	54.9	41.6
12	" 13	1184.	90.	285.7		19.7	48.8
13	" 20	1240.	56.	304.7			8.
14	" 27	1300.	60.	367.4			
15	Feb. 3	1326.	26.	300.8			
16	" 10	1364.	38.	352.8			
Total			840.	2631.	837.1	743.6	238.1

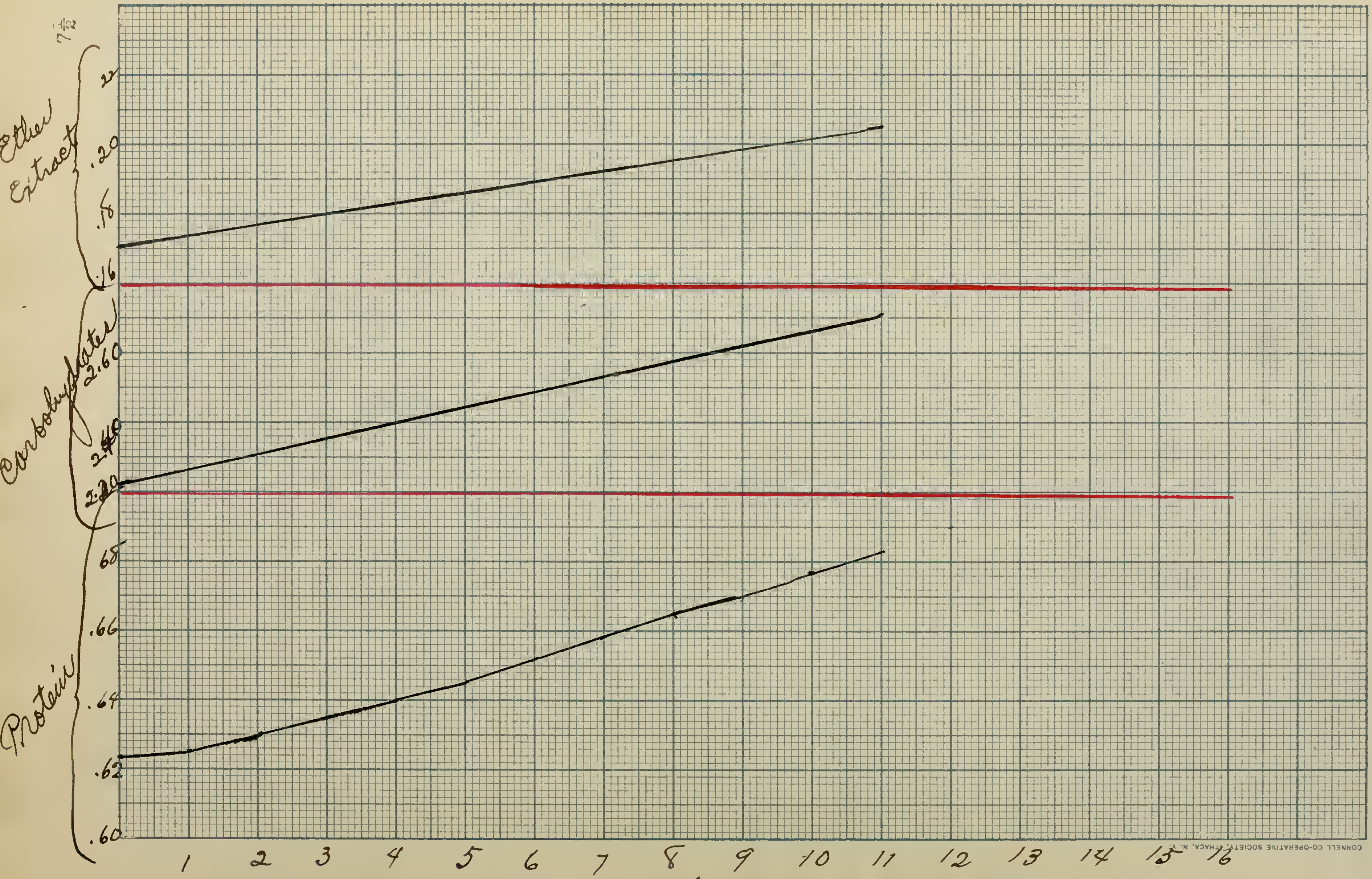

Chart O
Digestible Nutrients Required per cent of Live Weight,
One Week Period.

DISCUSSION OF CHARTS.

In the following Charts brown ink has been used to represent Lot I. Blue ink for Lot II and red ink for Lot III.

The heavy vertical lines of the Chart represent the ends of the weeks during the experiment as can furthur be seen by the labeling at the top and bottom of Charts.

The horizontal lines of the Charts represent values such as the subject of the Chart indicates.

Chart O.

Digestible Nutrients Required.

Chart O shows the digestible nutrients required in per cent of live weight by one week periods.

This Chart is based on results obtained from previous experiments conducted by the Illinois Experiment Station. The lower part represents the amount of protein which was considered the most advisable for pigs of this age and weight and at such stages of the experiment. The same is true of the carbohydrates which is represented in the middle portion of the Chart. The Ether Extract required in the ration is then represented in the upper portion.

This then was the guide for the experiment with Lots II and III. It does not concern Lot I as these pigs were fed only ear corn in such amounts as they would clean up regardless of the amount of digestible nutrients contained.

By referring to Chart O it can be seen that the first ration the pigs received contained .623# protein, 2.22# carbohydrates, and .171# Ether Extract or fat and that this was

increased gradually each day so the first ration of the second week contained .625# protein 2.26# carbohydrates and .172# ether extract per 100# live weight per day. This gradually increasing of protein, carbohydrates and fat each day was continued through the twelfth week of the experiment. After this time they were fed corn meal alone because it was considered that corn fed alone, during the closing few weeks of a feeding period, produced a better finished product for the market than would any other feed or combinations of feeds.

In making the calculations the analyses of feeds as given in Henrys' Feeds and Feeding were used.

To make the increase uniform it was necessary to compound a ration such that it would contain the required amount of digestible nutrients and still be of such feed as would be eaten regularly.

There was still another phase to be considered in compounding this ration. If a large amount of coarse feeds were fed at first, making the ration bulky, the digestive capacity of the pigs would be developed to a greater extent so that later in the feeding experiment they could consume more feed than they would other wise have been able to do.

To make up this bulkiness it was necessary to use large amounts of bran as this was the most bulky of feeds to be used in the experiment. Then in compounding the ration, as much bran was used as the pigs would readily clean up when fed. Corn meal, middlings, and tankage were fed in small amounts at the beginning of the experiment and slowly increased as the

experiment continued, in order to furnish the remainder of the digestible nutrients, and to make the ration more palatable. It has been found that a hog does better on a mixed ration.

So the first ration contained for Lots II and III, 5# corn meal, 13.3# bran, 1.7# middlings, and 1# tankage. This ration contained practically the amount of digestible nutrients as is indicated at the beginning of the Chart.

The bran was increased to the seventh week in such quantities as was readily eaten and then gradually decreased to the end of the eleventh week when it was dropped from the ration. Corn meal and middlings were gradually increased and at the end of third week the ration contained equal weights of each. This proportion of corn meal and middlings continued to the end of the ninth week when the corn meal was more rapidly increased and the middlings decreased till at the end of the twelfth week it was dropped. The tankage was held practically constant at 1.1 pounds, till after the eighth week, then it was gradually increased to the end of the twelfth week when it was dropped. This left the last four weeks ration to consist of only corn meal which was fed in such amounts as they would clean up at each feeding.

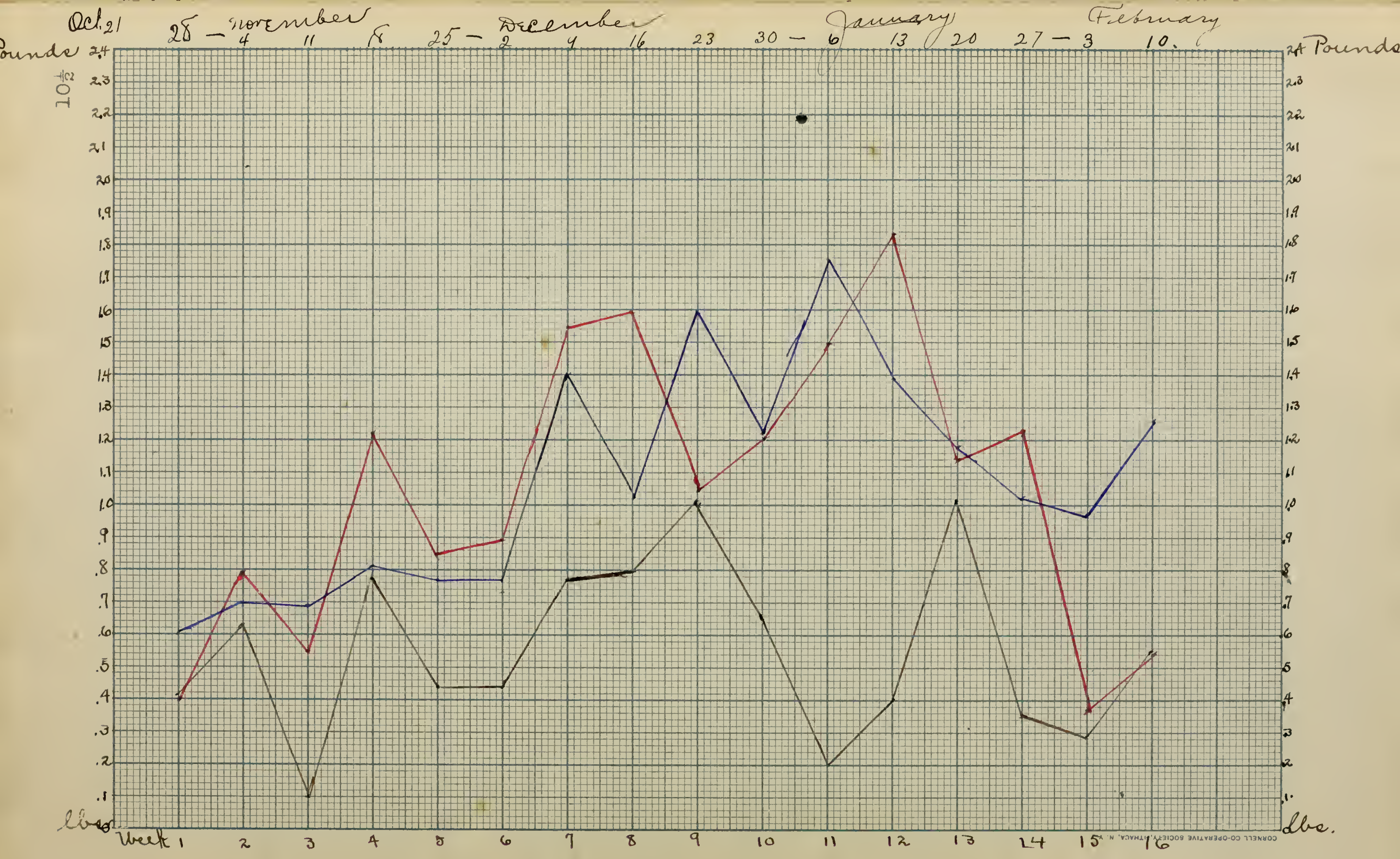

Chart 1

Individual Average Daily Gains,
One Week Period.

Chart I.

Average Daily Gains.

Chart I represents the individual average daily gains for one week periods. This is computed from the total gain of each lot for one week periods.

The gains as can be seen at a glance were not uniform with any lot and furthur they were not alike in increase or decrease as compared to previous weeks.

Lot I shows little regularity and none whatever after the fifth week. Lot II shows, with one exception, marked regularity, in that alternate weeks the gain is greater than previous week, up to the thirteenth week when there is a sudden change.

Lot III is not so regular and more deviations appear. At the end of the first week Lot II is ahead with an average of .61#, per day. Lot I is second with an average gain of .42# per day while Lot III has the least .4# per day.

By referring to the Chart it can be seen that the curves which represent these different lots start at those points. Now it is the purpose of this Chart to show the comparison of the three lots from one week to the next.

During the second week the curves all have an upward direction showing that the daily gains are increasing but by the end of the week the lots have changed positions with Lot I below Lot III above and Lot II between. Thus Lot III made the most rapid gain during the week.

By the end of the second week the positions of curves

are again changed, but this time all have been in a downward direction.Lot I is as low as .1# per day, Lot III .55# per day while the average of Lot II is only slightly lower than its previous week's record.

During the fourth week the direction of the curves are changed and ends with Lot III again above with an average daily gain of 1.22# per day. The upward tendency of Lot II was not so marked as was that of Lots I and III.

The fifth week resulted in a downward direction again of all the curves, but this time Lot III did not cross either of the others. The curves remain in this relative position to the end of the seventh week, making only a slight increase during the sixth week,but the seventh week all show a rapid increase by an upward direction of the curves. The eighth week shows a variation in that Lots I and III go in an upward direction while Lot II retains its regularity of up one week and down the next so it makes a downward turn and continues this regularity through the twelfth week.

During the ninth week there appears a change unlike any preceding.. Lot III curves downward across Lot II to 1.04. While Lot I continues upward to 1.02 when it takes a sudden downward turn and continues through the eleventh week reaching as low as .2# per day, while Lot III takes an upward direction through the twelfth week. Here it turns down for one week and through the fourteenth week the decrease was checked and a slight upward turn for another week appears,but only to fall to .36 during the fifteenth week and closes at.54 at end of the experiment.

Chart 2.

Individual Average Daily Gains

Two Week Period.

During the twelfth and thirteenth weeks Lot I reaches 1.02# near Lot III. From here to the close of the fifteenth week there is a decline. The same is true of Lot II. Then both Lots I and II make an increase as did Lot III.

The close leaves the lots in the same position as in the beginning but Lot II is much farther ahead than at first. These fluctuations or ups and downs of the curves show very clearly the weekly variations.

Chart 2.

Chart 2 represents the individual average daily gains computed for two week periods instead of one week periods as is done in case of Chart 1.

By referring to the Chart and comparing it with Chart 1. it is seen that the fluctuations of all lots are greatly reduced.

During the first twelve weeks Lot II made the most consistent increasing gains of the experiment.

Lots II and III run more closely together than they did in Chart 1. Lot III crosses Lot II but twice while in Chart 1. they crossed eight times. Thus it is seen that the fluctuations are due to weekly variations.

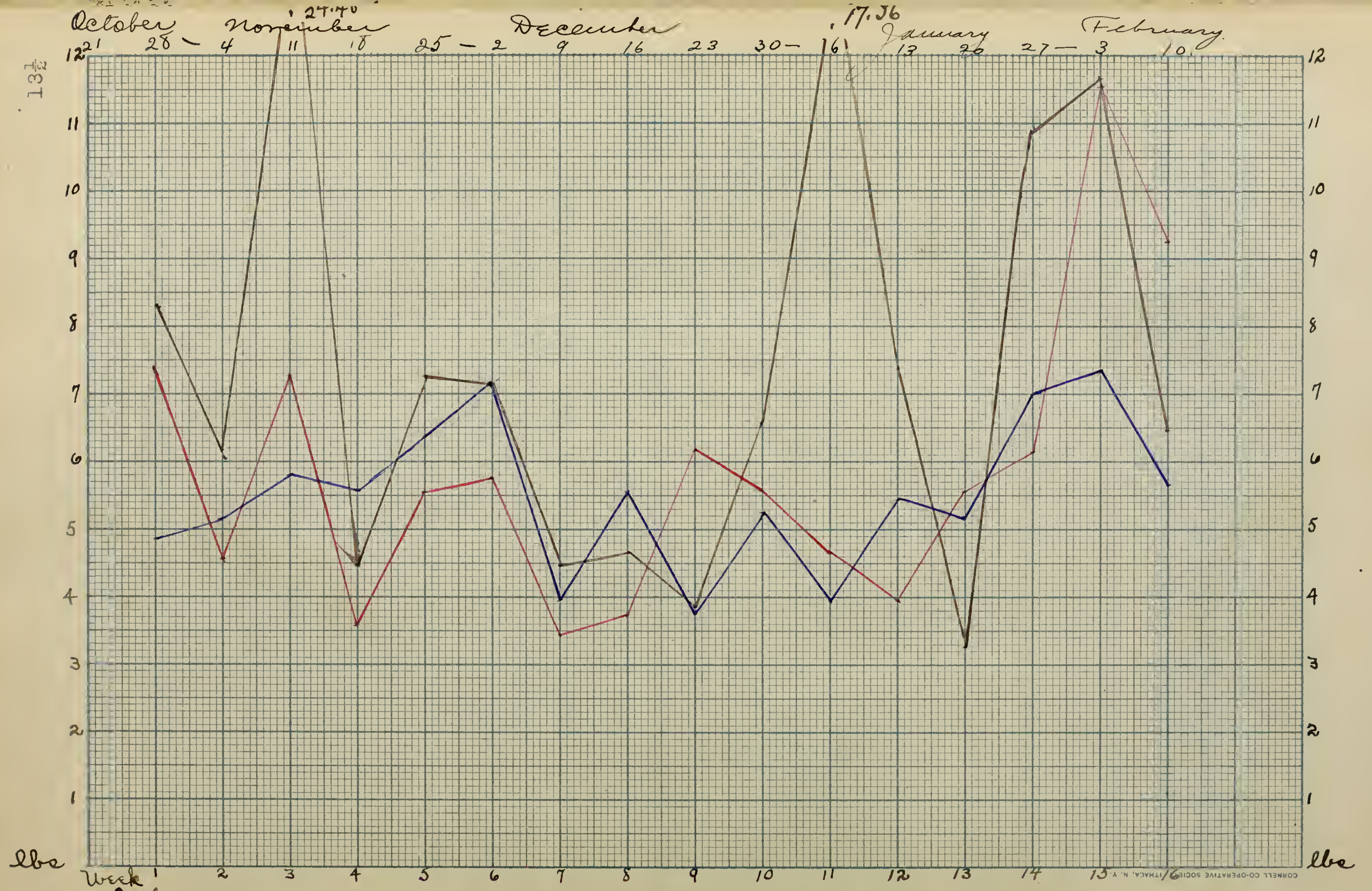

Chart 3
Total Dry Feed, per lb. Gain,
One Week Period.

Chart 3.

Chart 3 represents the total dry feed consumed for a pound of gain. The curve for Lot I started highest at 8.3 with Lot III next in order at 7.4 and Lot II at 4.85. The second week showed a decrease in all except Lot II which made a slight rise. The third week, however, the curve for each lot went up, Lot I making an especially high raise, 24.48# of dry feed being required to make one pound of gain. Lot III made a considerable rise, 7.27# of dry feed being required to make a pound of gain. Following this there was a decrease for a week and then a rise again. The amount of feed per pound gain alternately increased and decreased from week to week with an occassional variation of a rise for two weeks at a time. The eleventh week, the curve in Lot I rose to 17.36# per day of dry feed per pound gain, then for the next two weeks it took a decided downward dip to 3.25 and then a sudden rise again for the next two weeks. This was followed by another sudden dip, the curve at the close of the experiment ending upon 6.45.

Lot II and III after the seventh week ran fairly uniform in general with a constant rising and falling curve until the twelfth week in Lot III and the thirteenth in Lot II, the curve rose rapidly until the end of the fifteenth week. At this time the curve for Lot III stood at 11.54 and Lot II at 7.30. Then there was a sudden downward inclination until at the end Lot III rested at 9.25 and Lot II at 5.65. The fluctuations in Lot I, however, were most remarkable, the high point having been reached when, during the third week, 24.48# of dry feed were

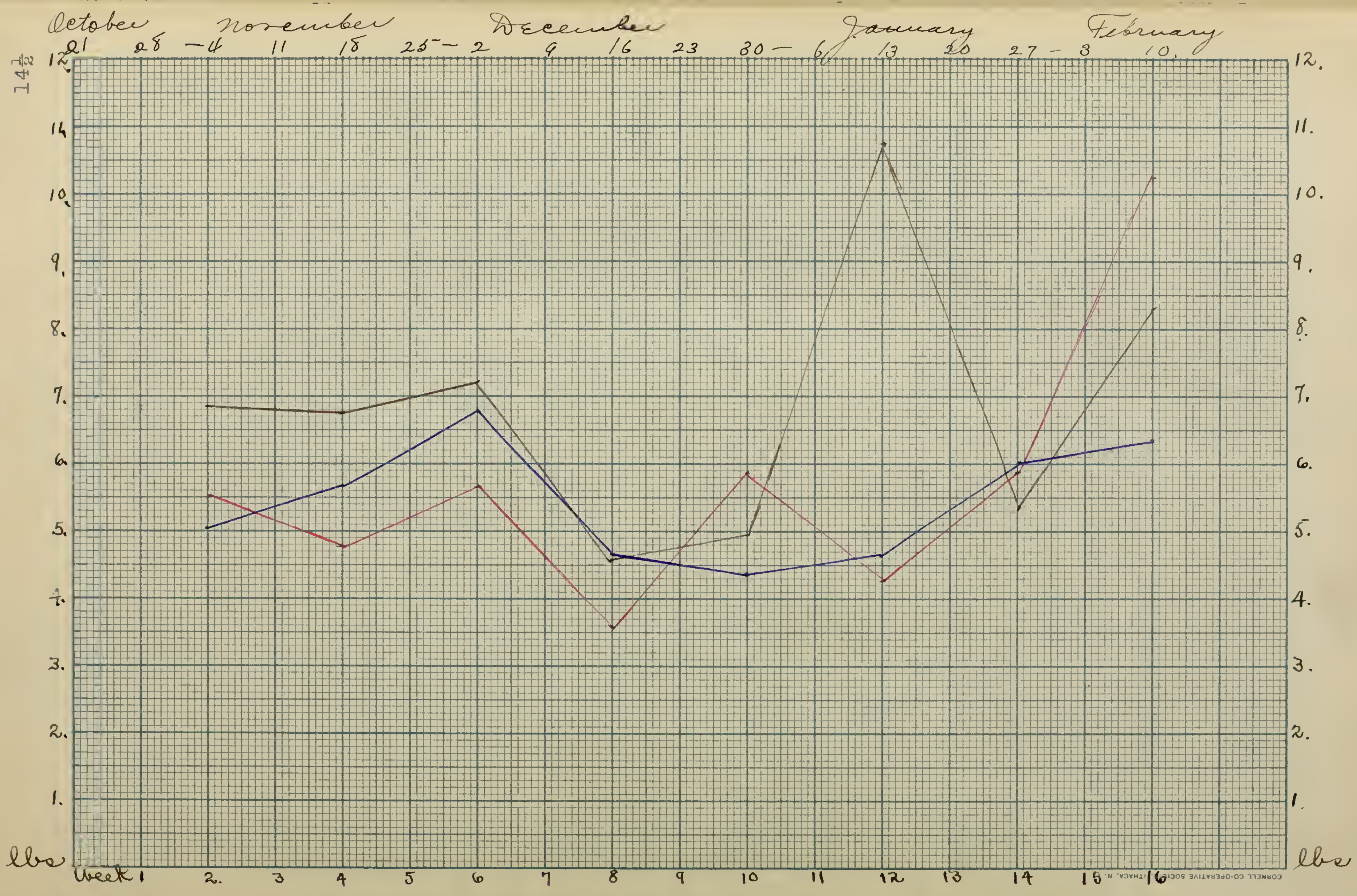

Chart 4
Total Dry Feed, per lb. Gain,
Two Week Period.

required to make a pound gain and the low mark touched during the twelfth week when only 3.25# of dry matter were required.

Chart 4.

Chart 4 is the same as Chart 3 only the dry feed required for a pound gain is represented in two week periods instead of one. The curves for each lot start at 6.85 for Lot I, 5.05 for Lot II and 5.5 for Lot III. It is noticeable that the high raise in Chart 3 for Lot I for the second week has disappeared owing to the average of the two weeks. During the third week, the curve for Lot II goes above Lot III and remains above until the eighth week when Lot III rises above it and remains above until the twelfth week when the positions are changed. Here Lot II goes above until the fourteenth week when Lot III again goes above Lot II and remains above until the close. Lot I starting above Lots II and III and runs fairly uniform until the sixth week when it drops below Lot II and in the ninth week is below Lot III. Then in the tenth week it takes a sudden rise and goes rapidly upward until the twelfth week and then sinks again until the fourteenth when it raises until the end, closing between Lots II and III.

This Chart shows that the feed per pound gain in Lot II was fairly constant throughout the experiment, less constant in Lot III and very irregular in Lot I.

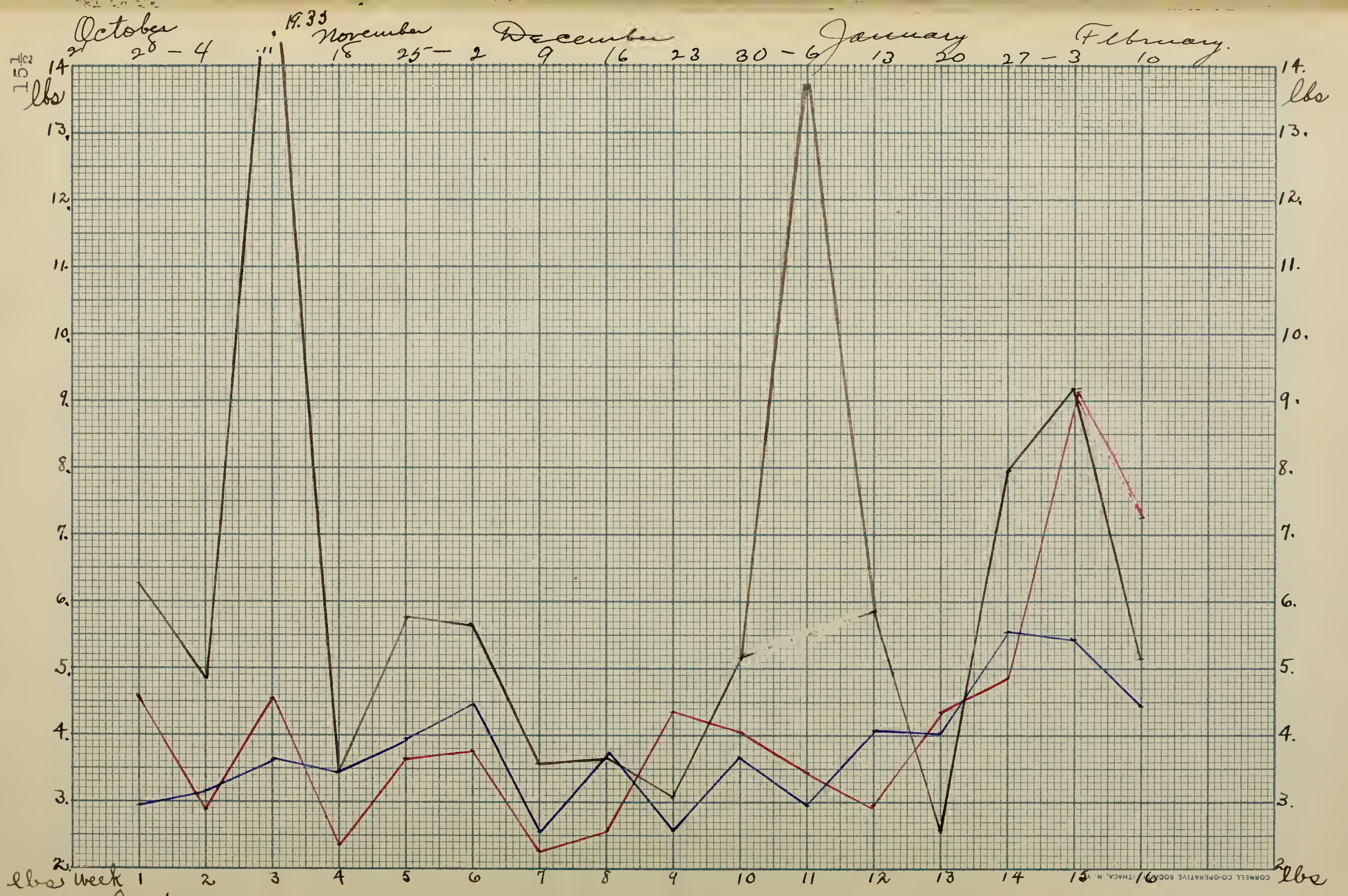

Chart 5

Total Digestible Nutrients, per lb. Gain,
One Week Period.

Chart 5.

Chart 5 shows the total digestible nutrients per pound gain in one week periods. The curve for Lot I in this chart is very irregular, beginning at 6.25, rising to 19.33 the third week, falling to 3.50 the fourth week, fluctuating upward and downward until the eleventh week when it suddenly rises and then falls to 2.50 by the end of the thirteenth week. Then it rises again until during the fifteenth week, 9.15# of digestible nutrients are required to make one pound gain. Lot III starts above Lot II but they cross the second, third, fourth, ninth, twelfth, thirteenth, fourteenth and fifteenth weeks, ending as they begun, with Lot III the highest. The curves, although irregular are fairly uniform as a whole. There is a decline in the amount of digestible nutrients required for one pound gain during the middle of the experiment, but it increases until both curves finish above the average height.

Chart 6

Total Digestible Nutrients per lb. Gain,
Two Week Period.

Chart 6.

Chart 6 is similar to Chart 5 only the curve is plotted for two week periods instead of one. In this Chart, the curves show that more digestible nutrients were required to make a pound gain in Lot I than in Lot II or III until the tenth week when the curve for Lot I sinks below that of Lot III. It rises immediately, however, and goes rapidly upward until the twelfth week, sinking below both Lots II and III during the fourteenth week. From this point it rises, goes above Lot II and ends below Lot III. Lots II and III run fairly close together, Lot III being above at the beginning. They cross the third, ninth, twelfth, and fifteenth weeks, Lot III finishing above both the other lots. This Chart shows that in Lot I where only corn was fed, much more digestible nutrients were required to make a pound of gain than in Lots II and III where there was a mixed ration with a higher per cent of protein.

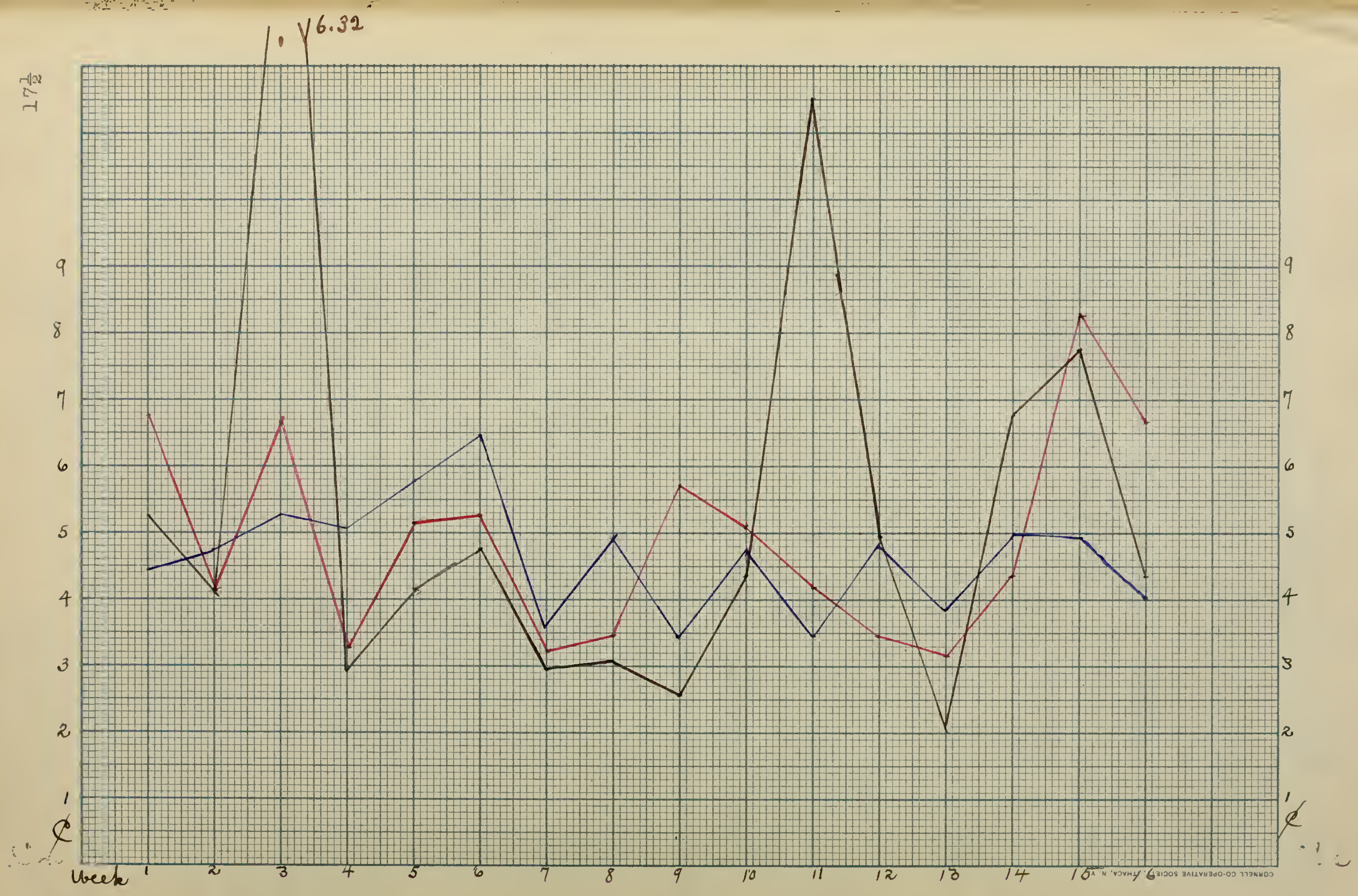

Chart 7.
Cost, per lb. Gain,
One Week Period.

Chart 7.

Chart 7 represents the cost per pound gain in weekly periods. As does most of the other Charts, Chart 7 shows a great irregularity for Lot I. The third week the curve for this lot goes rapidly upward, a pound of gain costing 16.32 cents per pound. The next week, however, it makes a rapid decline and goes to 3.9 cents per pound gain. Then the curve rises again until the sixth week when it goes downward, rises slightly the eighth, goes downward the ninth and then makes a rapid inclination in the tenth and eleventh weeks, the latter week the cost reaching 11.5 cents per pound. The curve from here goes rapidly downward again the twelfth and thirteenth weeks, rises again the fourteenth and fifteenth, falls the sixteenth and ends between Lots II and III.

Lot III starts high, a pound of gain costing 6.73 cents per pound. Lot II starts 4.45. Lot III is much more irregular than Lot II. The curve for Lot III shows wide variations upward and downward with a tendency to lower the cost. The fourteenth and fifteenth weeks, however, the curve rises rapidly, and falls again the sixteenth, finishing the highest of any of the three lots.

The curve for Lot II shows more constancy throughout. The cost of gain in the beginning was 4.45 cents per pound. This, however, shows a general tendency to rise until the close of the sixth week, after which, with the usual weekly upward and downward movements, it runs fairly uniform, with a tendency to rise at the close, until the end of the experiment, finishing the lowest of any of the lots.

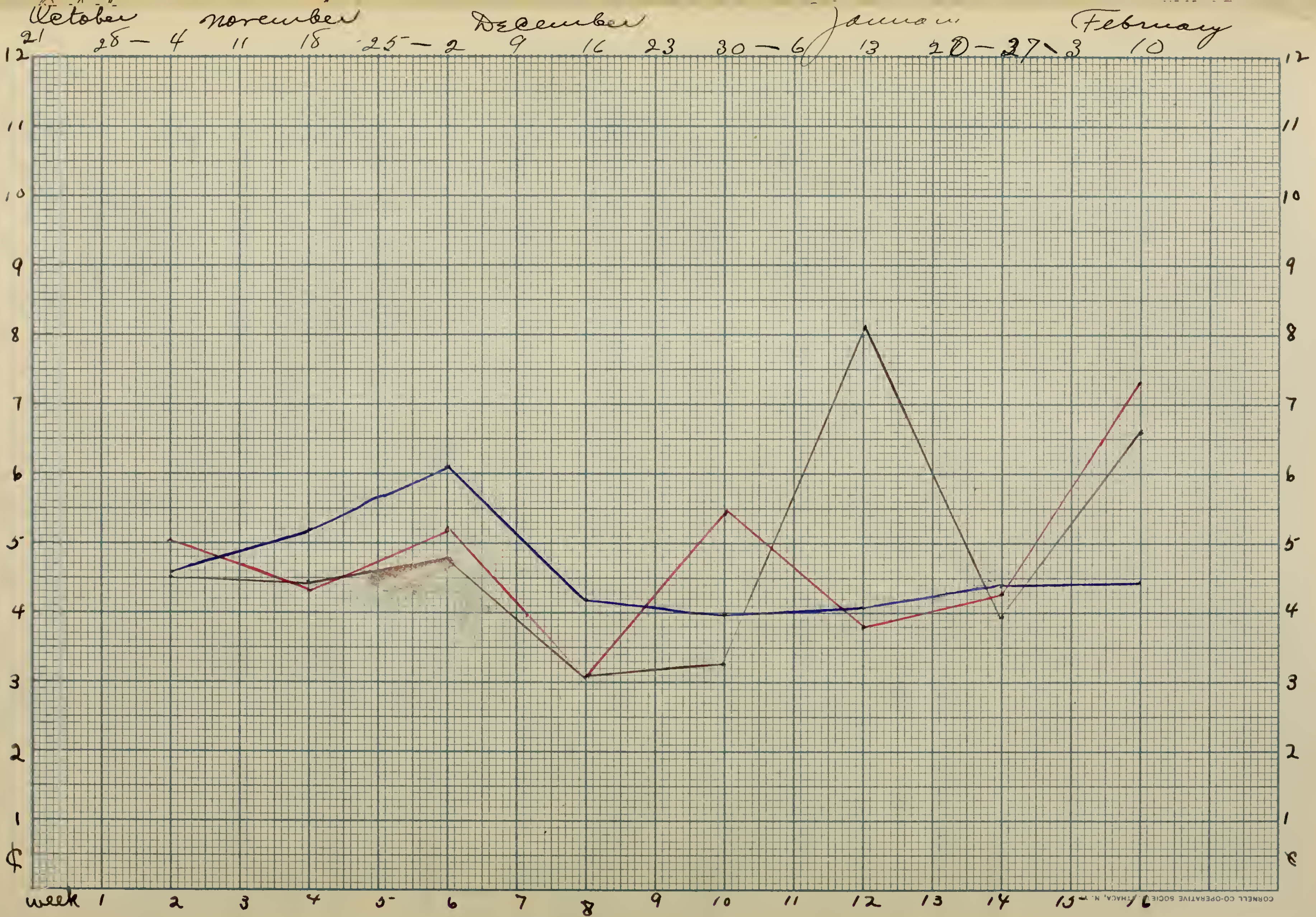

Chart 8.

Cost, per lb. gain,

Chart 8.

Chart 8 is similar to Chart 7 only the curve represents two week periods instead of one. The curve for Lot I in this Chart loses the high upward tendency for the third week as shown in Chart 7. This curve runs fairly uniform the first six weeks, when it goes down until the eighth, rises slowly the next two weeks, and reaches the highest mark of all the twelfth week. From this it goes rapidly downward the next two weeks, and rises the last two weeks of the experiment, closing between Lots II and III. The highest cost per pound gain in any two week period for Lot I was 8.15 cents per pound while the lowest was 3.1 cents per pound.

The curve for Lot II is again most uniform. It rises until the sixth week, goes downward until the tenth and slowly rises to the close. From the third until the ninth week the curve is the highest of any of the lots.

The curve for Lot III is more irregular than Lot II, but not so much so as Lot I. It goes downward two weeks and upward the next two until the last four, during which time it shows a rise upward, finishing the highest of any in the experiment.

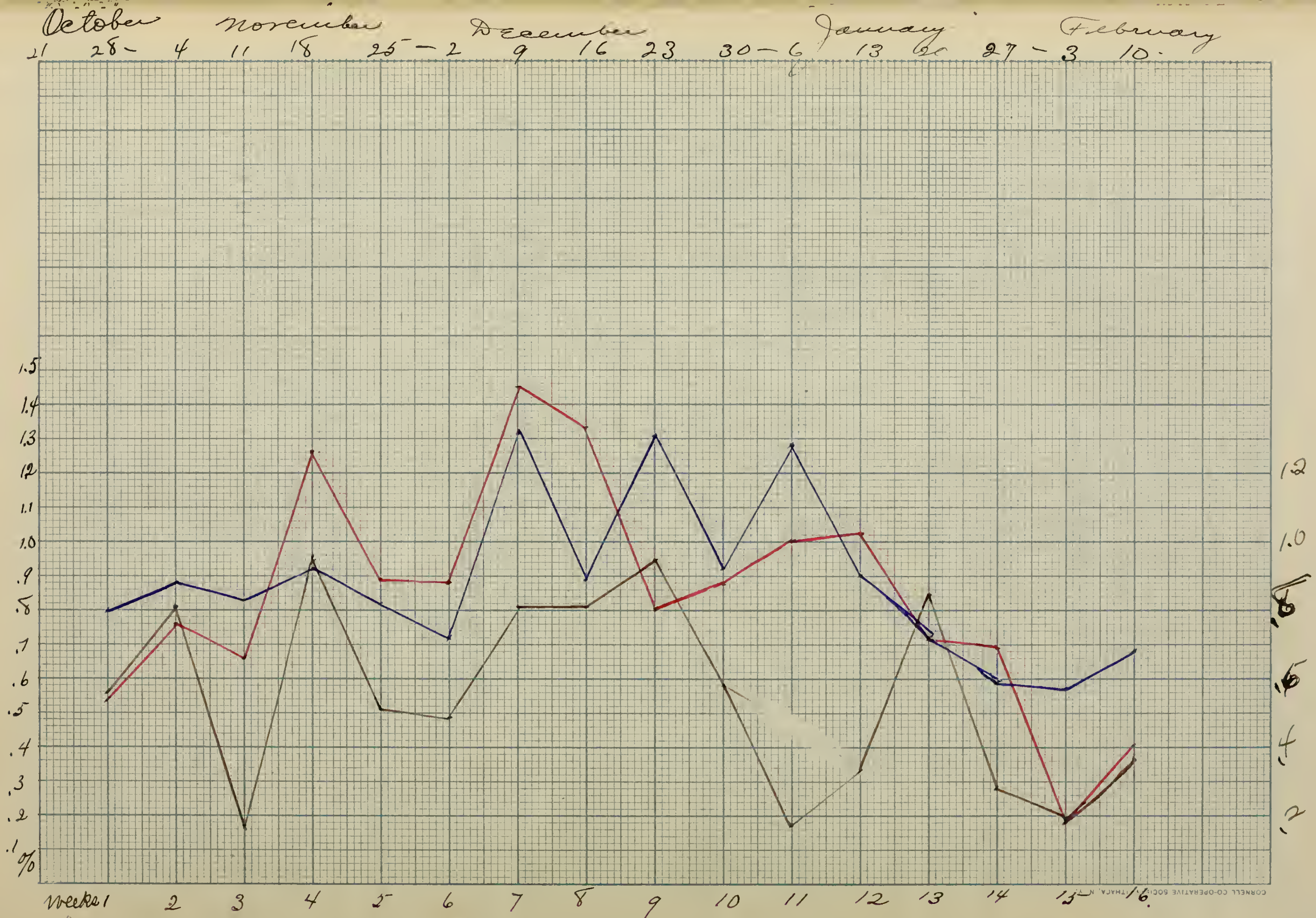

Chart 9.

Average Daily Gains, per 100 lbs Live Weight,

Chart 9.

Chart 9 represents the average daily gains per 100 pounds live weight. Computed for weekly periods.

This Chart is clearly marked with the weekly variations but as was in the case of ChartsI and II the curve for Lot I is more regular than either of the others. Lot II starts above Lots I and III with .8 pounds gain per 100 pounds live weight and closes ahead with .68.

It is very regular in its fluctuations with but one exception before it reaches the end of the twelfth week. From this point there is a gradual decline through the fifteenth week. Here the direction changes to an upward course for the last week.

Lot II reaches its high point during the seventh and the other extreme occurred during the fifteenth week. Lots III and I start at .54 and .56 respectfully. Both make an increase during the first week but a sudden downward trend in the third with Lot I crossing Lot III. During the fourth week a rapid increase is taken and both cross Lot II, while the fifth week brings them on a downward direction similar to Lot II. Thus far they have been up one week and down the next, but here the regularity is changed and all make a second weeks' decline.

During the seventh week all turn in an upward direction only to change courses in the eighth week, while during the ninth week Lots I and II curve upward and Lot III downward crossing both the others.

Another change is noted in direction during the tenth week,

that is, each lot follows the order of the regularity in turn in the opposite direction at the end of each week. This causes Lot III to cross Lot I but not Lot II in its upward direction which it continues through the twelfth week.

During the eleventh week Lots I and II go in opposite direction, very rapidly, Lot I reaching as low as .17# average gain per 100 pounds live weight. At this point both Lot I and II change their directions and by the end of the thirteenth week they have crossed each other. Here finds the three lots close together but the following two weeks takes them in a downward direction. Lot III crosses Lot II and at the end of the fifteenth week Lots I and III reach .18 while Lot II has only fallen as far as .57.

Each turn upward during the closing week and end with Lot I at .36, Lot III at .41 and Lot II .68.

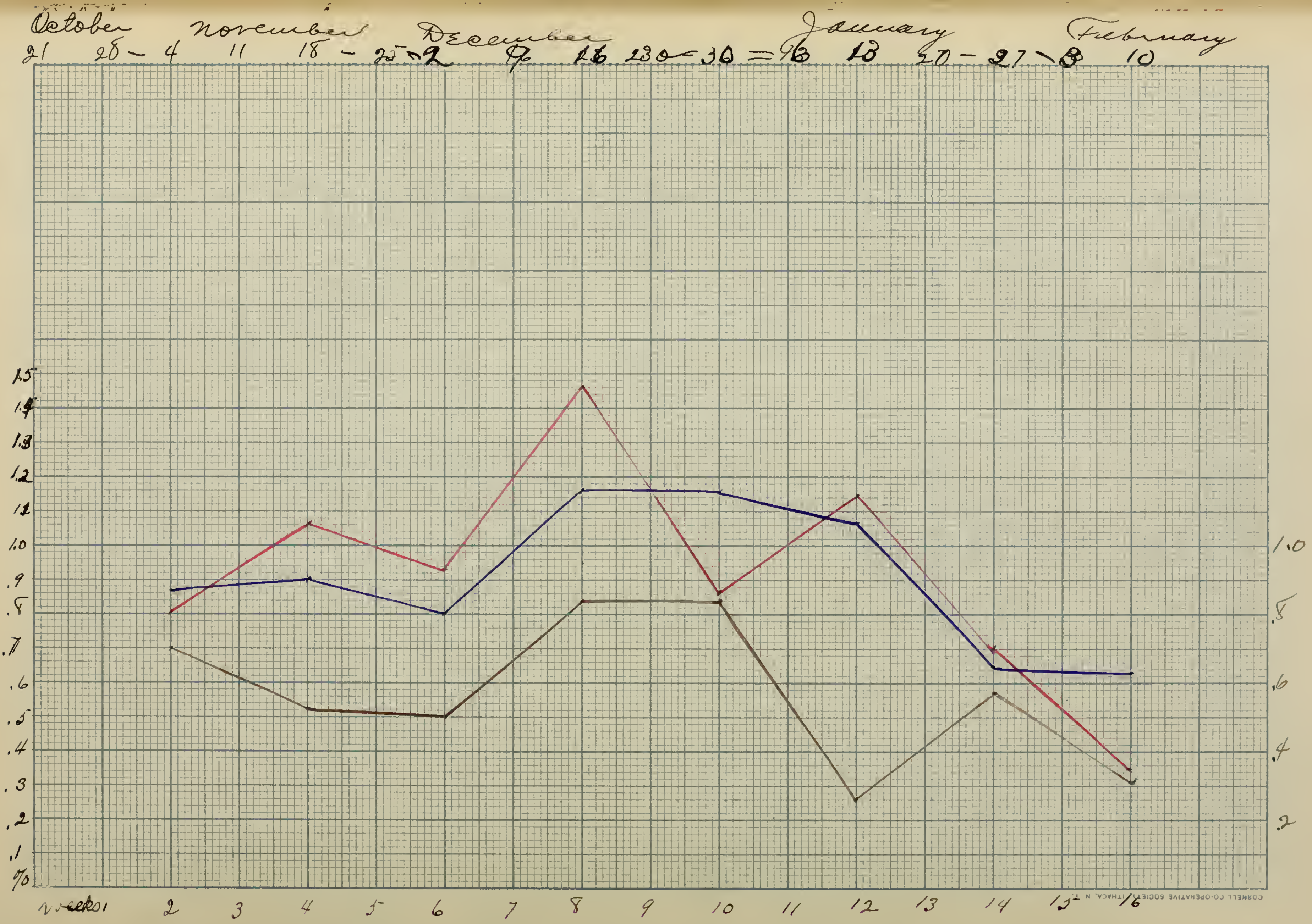

Chart 10.
Average Daily Gains, per 100 lbs Live Weight,

Chart 10.

Chart 10 represents the same material as Chart 9 except it is calculated for two week periods. It can be seen at once that the weekly variations are reduced.

The curves do not start in the same order as in Chart 9 where Lot III was below, Lot I next and Lot II above, but Lots I and III have changed places leaving Lot II to hold the upper position.

Lots I and II again run along in relative positions through the twelfth week. Here they turn toward each other and at the end of the fourteenth week they are only .13 apart but close at the end of the experiment with Lot I at .31 and Lot II at .63.

Lot III starting between Lots I and II at .8# per 100 pounds live weight, crosses Lot II by the end of the fourth week. Then it retains its relative position to the end of the eighth, but by the end of the tenth it has a downward direction crosses Lot II and runs close to Lot I. During the eleventh and twelfth weeks, Lot III takes an upward turn and again crosses Lot II. Lot III holds this relative position with Lot II through the thirteenth and fourteenth weeks.

During the last two weeks Lot III continues its downward direction and crosses Lot II and ends near Lot I at .35# per 100 pounds live weight.

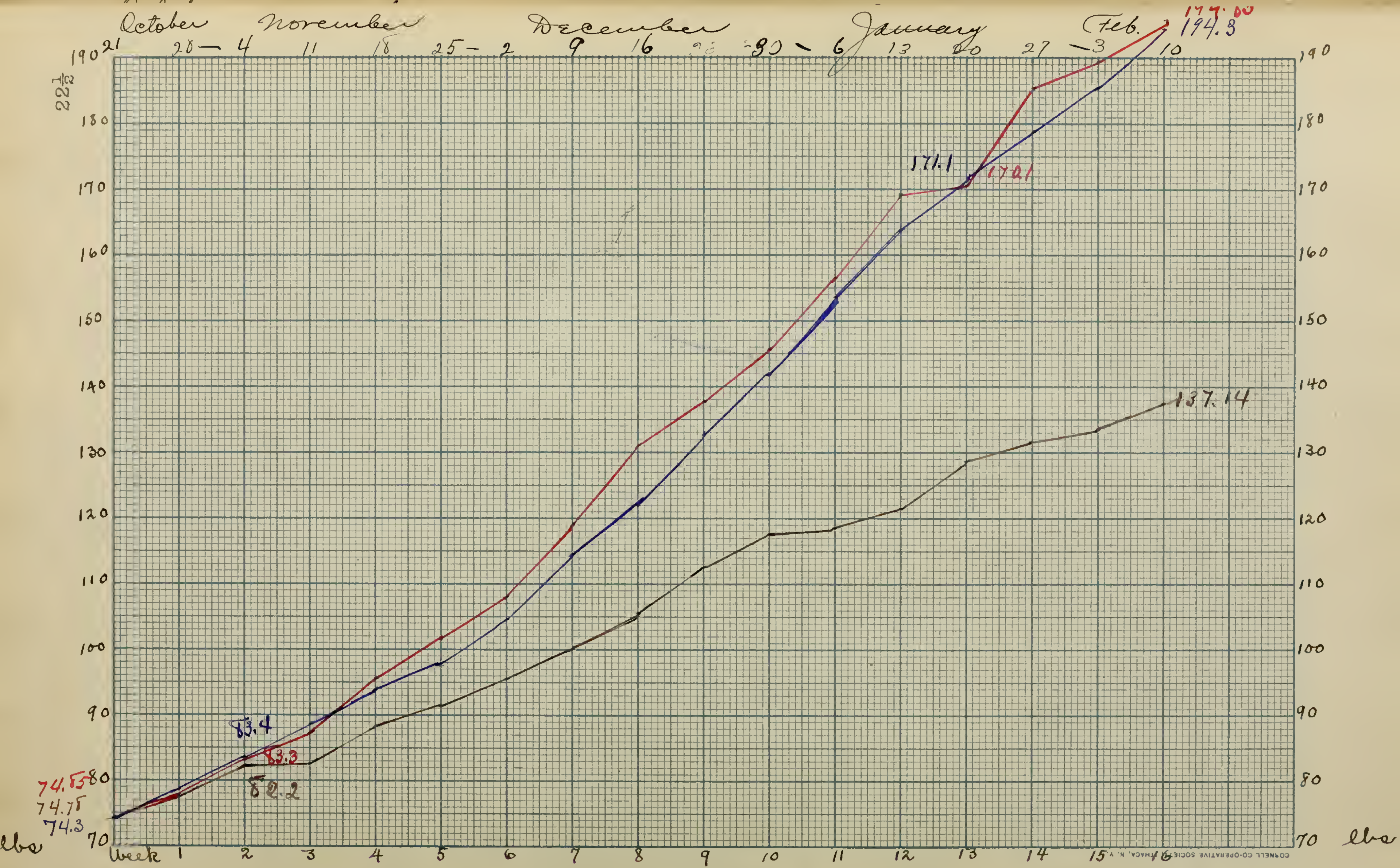

Chart 11.

Average Live Weight,
One Week Period.

Chart 11.

Average Live Weight.

Chart 11 represents the average live weight of the pigs of each lot during the experiment. As has been before stated weights were taken only on Saturday morning of each week.

By referring to the Chart it can be seen that the average weight at the beginning was practically the same and that the gains the first two weeks were much the same but Lot I fell below and Lot II gained the upper limit of the lots which it retained till sometime during the fourth week when Lot III crosses above. Curves for Lot II and III run along practically side by side with Lot III a little above to the end of the twelfth week. At this point Lot III fails to make good gains and Lot II rises above. During the fourteenth week Lot III makes a rapid increase and is again in the lead. Lot III does not keep this distance above but at the close it is .55# ahead.

During the entire experiment Lot II made the most consistent and gradual increase. There is not a single deviation as is true of Lots I and III.

Lot I after the third week made a gradual increase to the end of the tenth week but the increase was not nearly so rapid as was in Lots II and III. From this time on the gains varied greatly. At the close the average weight was only 137# for Lot I, while Lot II averaged 194.3# and Lot III 184.85#, it having been respectively 74.78#, 74.3#, and 74.85# at the beginning.

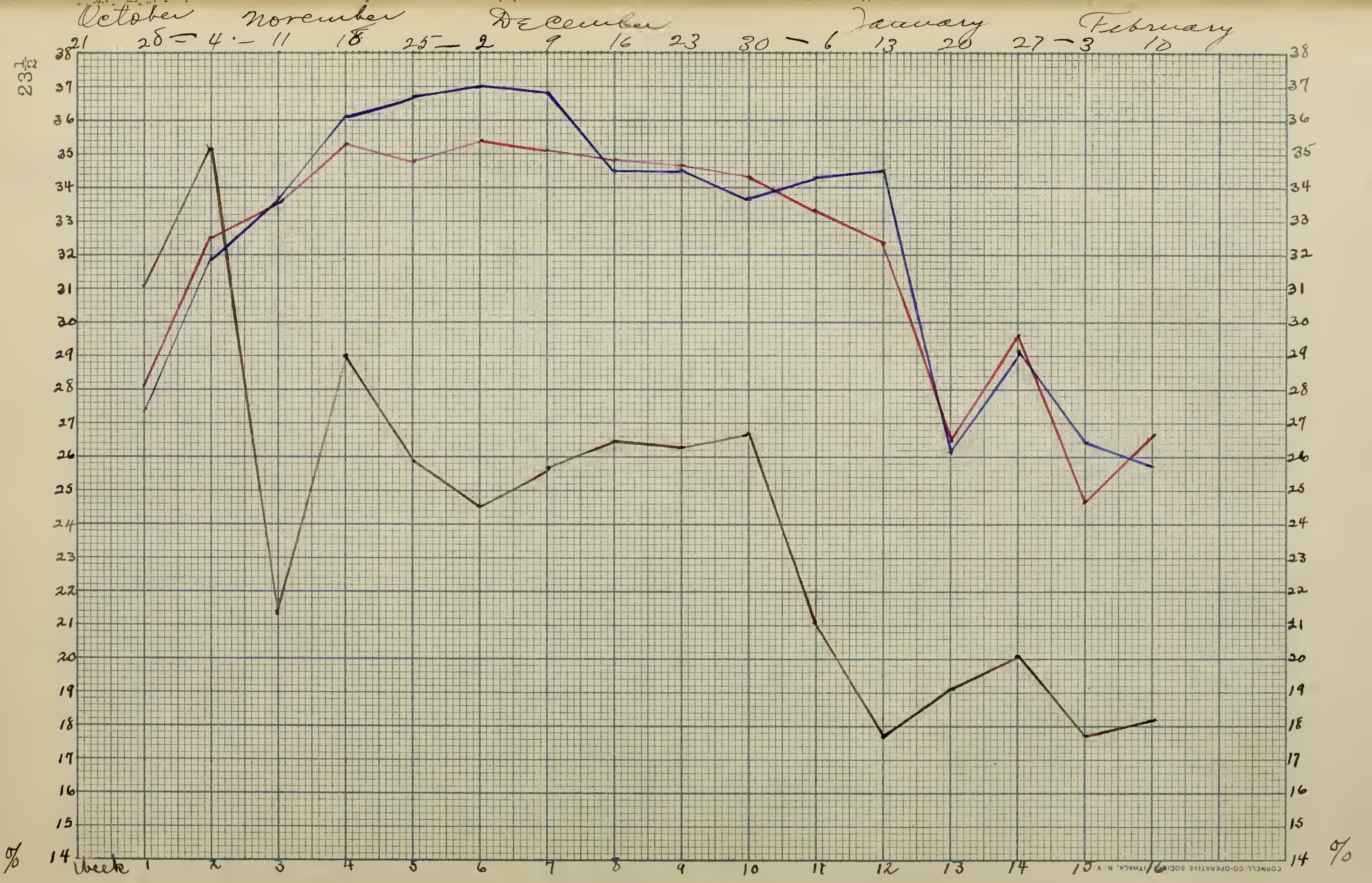

Chart 12
Total Dry Feed eaten, percent Live Weight,
One Week Period.

Chart 12.

Chart 12 shows the total dry feed eaten in per cent of live weight in weekly periods. It is noticeable in this Chart that Lot I with the exception of the first week,is far below Lots II and III. From the start the tendency of the curve was to go downward. From the fifth to the tenth week, the curve runs fairly level from which time the tendency seemed to be downward for the remainder of the experiment. Lots II and III run together most of the way with Lot II slightly above most of the time. From the beginning the tendency was upward for six weeks, from which time to the end the tendency was downward. In Lot I the highest amount of dry feed eaten in per cent of live weight, was during the second week when 35.2% was eaten. The lowest was during the fifteenth week when only 17.7% was eaten. The high mark for Lot II was 37% during the sixth week and the low mark 25.75% for the sixteenth week. Lot III was the highest for the sixth week when 24.6% was eaten.

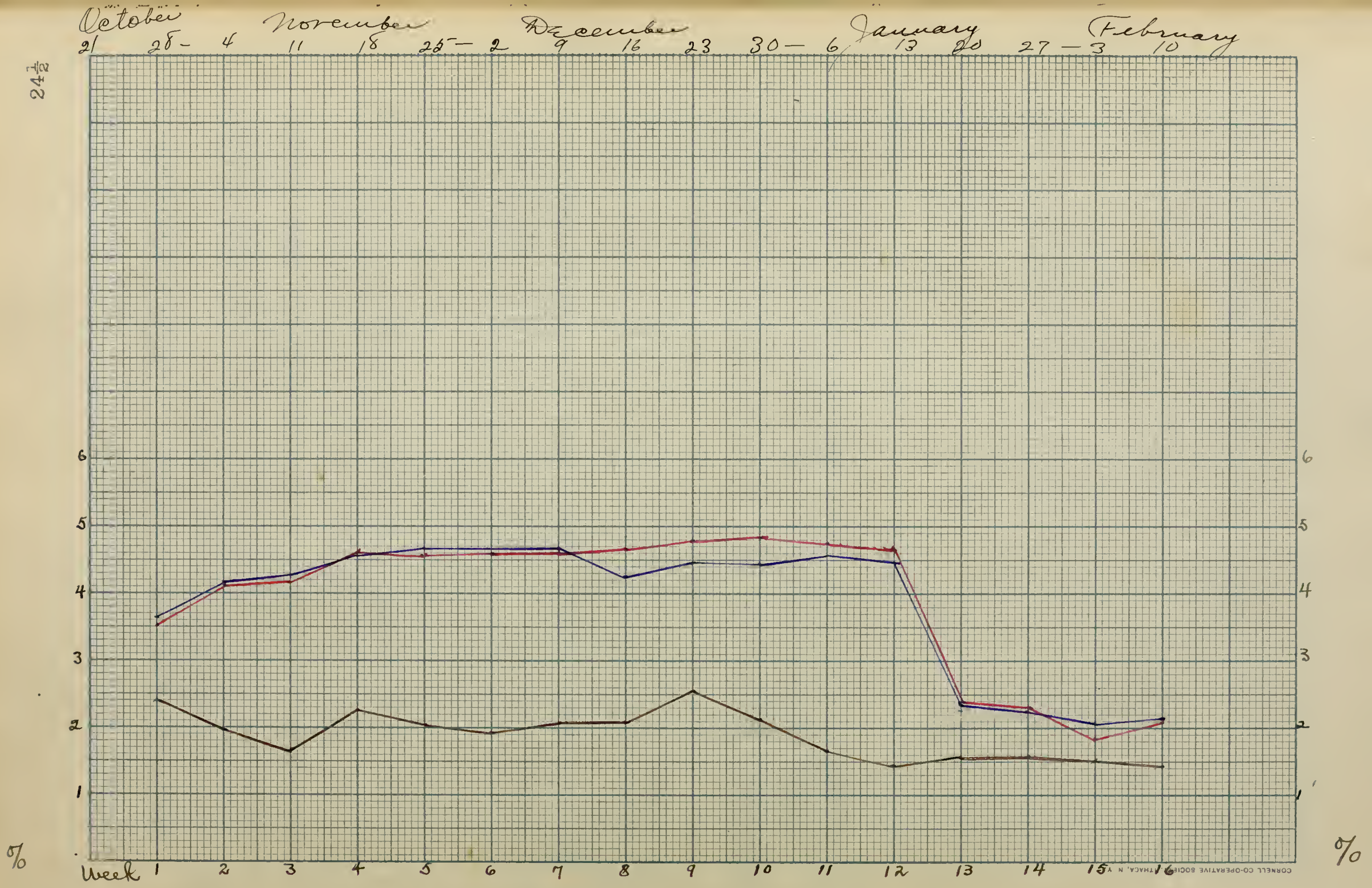

Chart 13
Protein Fed in per cent Live Weight,
One Week Period.

Chart 13.

Chart 13 represents the amount of protein fed in per cent of live weight during one week periods.

By referring to the Chart it is seen that Lots II and III run along together with Lot II above during the first three weeks and at the end of the fourth week Lot III comes ahead where it remains only a short time when at the end of the fifth week it is below .

During the sixth and seventh weeks Lots II and III run along almost parallel. Lot II drops below here and remains so through the twelfth week. Here there is a sudden drop but still Lot III stays above until the last two weeks when it falls below and closes at 2.2 while Lot II closes at 2.25.

Lot I is far below Lots II and III and it runs irregularly across as compared with the others while it closes at 1.4. These curves having commenced for Lot I at 2.4, and Lot II at 3.65, and Lot III at 3.51 respectively.

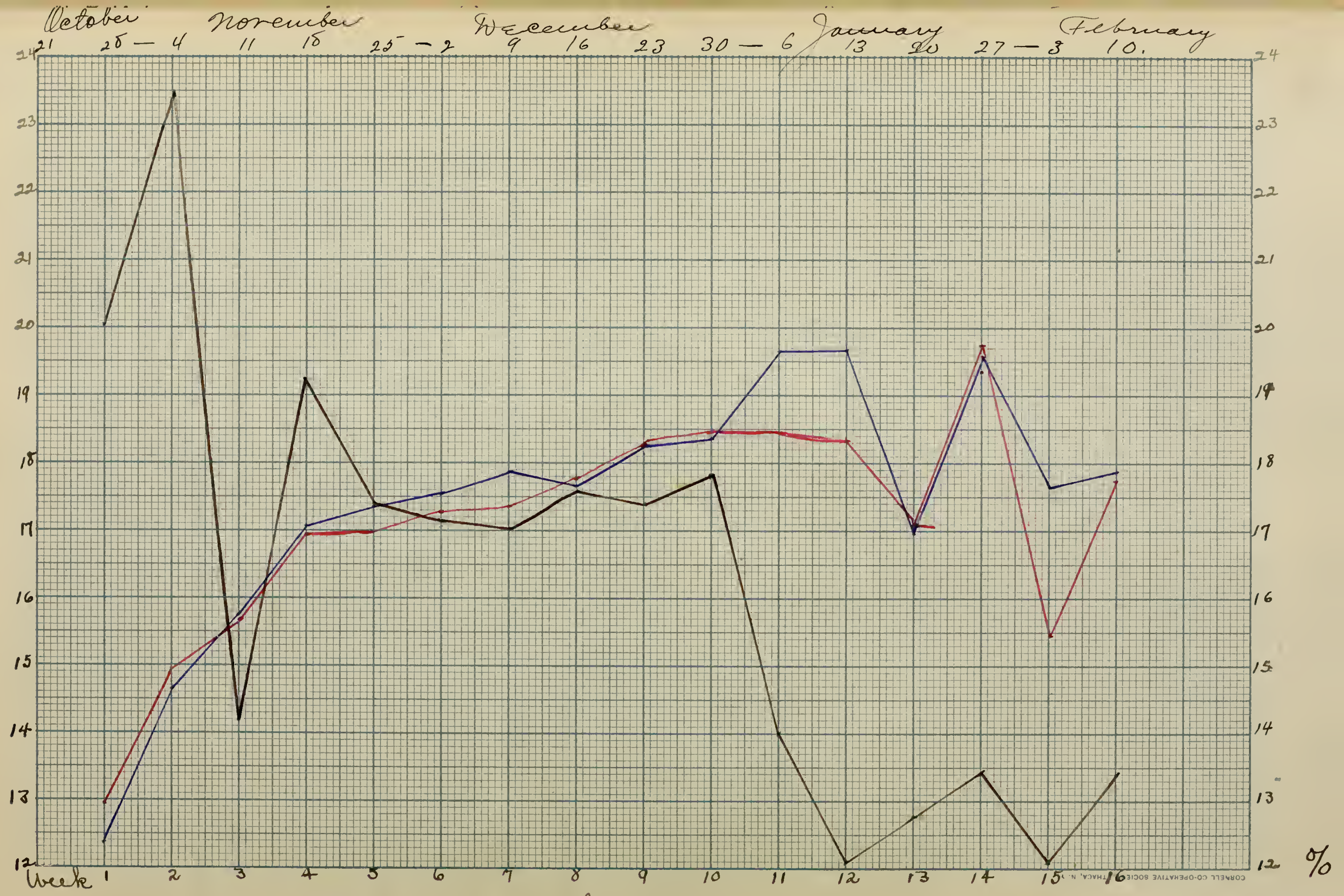

Chart 14
Carbohydrates Fed, per cent Live Weight,
One Week Period.

Chart 14.

Chart 14 represents the carbohydrates fed in per cent of live weight in one week periods. In this again Lot I is irregular, the tendency being downward. During the first week 23.5% of live weight were eaten in carbohydrates fed which marks the highest point in the whole experiment. There are continual fluctuations but at the close, only 13.4% was consumed, or scarcely more than half as much as in the beginning. On the other hand, Lots II and III began low at 12.4 and 12.95 respectively but gained until the tenth week. From here on with wide fluctuations, the curves average about level until the end, Lot II finishing at 17.9 and Lot III at 17.7. The mixed ration allowed an increase in the per cent of carbohydrates eaten while the single corn ration showed a decrease.

Chart 15
Ether Extract Fed, percent Live Weight,
One Week Period.

Chart 15.

Chart 15 represents the ether extract fed in per cent of live weight in one week periods. There are a number of irregularities in this Chart. Lot I goes up so that at the end of the second week it reaches 1.54% which is the highest point for that lot. The next week, however, it goes down to .935 but raises the next week. The tendency of the curve is to go downward from the beginning, although at times there are fluctuations upward. It closes at 8.25, the lowest of any of the three lots.

Lot II starts low at 7.8, increases slowly with fluctuations, rises rapidly through the tenth, eleventh and twelfth weeks when it reaches the high mark at 1.54 and then declines irregularly to the end of the experiment, closing at 1.170, the highest of any of the lots.

Lot III starts at .94 and rises fairly uniformly until the twelfth week when it reaches its highest point 1.49. From here it gradually declines with frequent rises until the end, closing at 1.01.

General Discussions.

As before stated, in preparing the data for these Charts, the per cent of dry feed, digestible nutrients, protein, carbohydrates, and ether extract were taken from Henry's Feeds and Feeding. The prices used for the feeds were, as follows:-

Corn meal,	40 ¢ per bushel.
Bran	$18 per ton.
Middlings	$20 per ton.
Tankage	$36 per ton.
Ear corn	37 ¢ per bushel.

In making the calculations for Lot I, the amount of shelled corn was computed from the ear corn, 70# being counted as a bushel of ear corn and 56# a bushel of shelled corn.

The curves for Lot I are the most irregular of them all. The curves for individual average daily gains went up and down. This was due to the fact that the pigs were fed a ration consisting wholly of corn with the exception of the grass eaten during the first month. The ration was what is called wide, that is, the amount of protein compared with carbohydrates was small. It was difficult to keep the pigs on feed, and practically impossible to increase the amount of feed, from the beginning. Not only was the ration low in protein and unbalanced, but it was not so palatable as a mixed ration.

Pigs do not relish corn alone as well as if something were added to it. Further the pigs were fed according to their appetite. By this method, the pig would usually get near the

amount he could consume. As a result of this method, the amount could be raised slightly for a short time, but a slump was sure to follow. At times, only ten pounds of ear corn were consumed in a day. Then again the amount wasted varied greatly. Even when the amount of feed consumed was large or constant, the gains would be low. This was due to the fact that a large amount of feed was wasted.

Further, the change of the feed at the beginning of the experiment caused small gains for a few weeks. Before beginning the experiment as before stated, the pigs were fed a highly nitrogenous ration. This established a high nitrogen waste, which when the feed was changed, required all the nitrogen in the ration, leaving no protein to assist the carbohydrates in making gains. After this waste had been reduced, however, there was less protein required to maintain it, and more could be used for making gains. From the tenth to twelfth weeks inclusive, the pigs had an illness similar to thumps which caused then to go off feed. These things account for the irregularities in the curves for this lot in Charts 1 and 2.

The dry feed and digestible nutrients would also vary with the feed consumed. Likewise the amount of digestible nutrients, protein, carbohydrates, and ether extract required for a pound gain would increase as the gains decreased. Then as the gains increased, these feeding compounds would decrease. Therefore when the curve goes up in Charts 1 and 2, it would go down in Charts 3, 4, 5, and 6 and vice versa. The same holds true with the costs. As the gains decrease, the costs increase,

consequently the irregular curve of Charts 7 and 8.

In Charts 9, and 10 it will be noticed that there is a tendency for the curve to run downward. This is due to the fact that a pig naturally makes smaller gains per hundred pounds of live weight as it grows older. While it is young, the system is in better condition, and it makes better use of its feed. Further a pig is able to consume a larger per cent of feed when young in proportion to its size than it does when it becomes older. The maintenance rations being practically the same, there is more feed to be applied to making gains. Consequently, there is the downward tendency of the curves in Charts 9 and 10.

The curve for Lot I in Charts 12, 13, 14 and 15 show a tendency to go downward, for the same reason. It will be noticed also that the curves are irregular, that is they go up and down, the cause of which so far as is known having been previously explained.

The curves throughout for the two week periods are more regular than the one week periods owing to the tendency of the hogs to gain more rapidly one week and less rapidly the next. Consequently in making the curves for the two week periods, the high and low gains are averaged.

Lot I required more dry feed to make a pound gain than did Lots II and III owing to the lack of protein. Carbohydrates were necessarily wasted for want of protein to supplement it. The gains, however, were cheaper because the feed, ear corn, was cheaper than the feeds used in Lots II and III.

Lot II was fed a mixed ration of corn meal, bran,

middlings and tankage mixed with sufficient water to make it into a thick mush, but not enough to make it thin and sloppy. At all times the digestible nutrients were computed upon the live weight as was previously explained in Chart O.

It was noticeable that through this experiment it was not so difficult to keep the pigs on full feed as it was in the others. It was the purpose at all times to make the pigs eat a maximum bulk of feed, but if one pig went off feed, some other one in the lot would be able to eat more, and thus consume all the feed given. This lot made the most consistent gains throughout the experiment. By referring to Chart 1 it will be seen that even Lot II had several ups and downs but this can not be explained further than that hogs do vary from week to week in their daily gains. But the sudden decline or decrease in gains during the latter part of the experiment was due to a slight illness something like the thumps,which caused a decrease in the feed consumed,so a decrease in daily gains. Another cause which may have affected the gains during this period was that the ration was mixed with luke warm water and fed in an open trough; as the weather was very cold the feed would sometimes freeze before it could be eaten. Thus it was impossible for the pigs to make consistent gains.

But it can be seen that the last week of the experiment after a period of falling, the gains began to increase again. This was due to the fact that at the beginning of the thirteenth week, the tankage was dropped out of the ration, and corn meal alone was fed to the close. The tankage, consisting largely of

protein, had caused a high nitrogen waste to be established which as before explained in Lot I required a large part of the protein in the corn meal to hold it up. But as in Lot I, this waste was reduced, and by the last week, more protein could assist the carbohydrates in making gains, hence the increase. Whether or not the gains would have increased or not had the experiment continued was not ascertained.

By referring to Chart 3 it can be seen that Lot II required less feed per pound gain at first than did Lot I and III. This was because the feed was similar to that fed previously, and there was not enough variation in the feed to make any difference in this factor.

From the twelfth week to the end of the experiment, the pigs required a larger amount of feed for a pound of gain than they had for the few weeks previous. This was due as was previously explained, to the protein content of the feed, the last four weeks the ration consisting of corn meal. Thus on Charts 3 and 4, the curve representing the total dry feed per pound gain has an upward tendency until the last week, when it makes a small rise due to the fact that the nitrogen waste has been lowered.

Referring to Charts 5 and 6, similar variations are noted as were in Charts 3 and 4. These variations are due to the same causes as the digestible nutrients fed correspond relatively to the amount of dry feed.

The curves for Lot II on Charts 7 and 8, correspond to those on Charts 1 and 2. The reasons for this are clear

because with uniform feeding and fluctuations in gains as was explained under Charts 1 and 2, the costs will vary.

The fluctuations in Charts 9 and 10 are due to the same causes that caused the variations in Charts 1 and 2, that is the illness, difficulty in manipulation, the variation in the protein content of the ration, and the variations which hogs make for unknown reasons from week to week.

It will be noticed that in Chart 12 the curve rises rapidly at the beginning of the experiment. This was due to the fact that the feed was being increased to get the pigs on full feed. From the sixth week on there was a downward tendency to the close of the experiment due to the age of the pigs as was explained under Lot I. Pigs will not eat so much in proportion to their live weight as they grow older.

Charts 13, 14 and 15, correspond very closely to Chart 12 as the protein, carbohydrates, and ether extract are based upon the dry feed, so the causes for these fluctuations are due to what has already been explained with the exception that when the tankage was dropped the curve representing the carbohydrates in per cent of live weight, turns rapidly upward, while the protein and fat take a sudden downward direction. This lot is much below Lot III in the amount of ether extract eaten because the ration for Lot III had to have the bulkiness reduced by the additions of corn meal, middlings and tankage and bran deducted. Had this been necessary with Lot II to the same extent as it was with Lot III, the curves representing the ether extract would have been more nearly together. The curves for

Lot III do not vary widely from those of Lot II as a whole. There are weekly variations which do not vary the same in each week for the two lots, that is one may be up and the other down at the same time but the positions as a rule are reversed the following week. The cause of these regular upward and downward tendencies are not known further than, as before stated, that hogs do as a rule make weekly variations.

It will be noticed that after the beginning or the first few weeks, that the pigs in Lot III made more consistent and cheaper gains for some time than did Lot II; that the amount of dry feed, digestible nutrients, protein and carbohydrates, was less per pound gain, and that the live weight was higher. It is to be supposed from the theory of the experiment that Lot III would make more satisfactory and cheaper gains than would Lot II for each pig got its share of the feed and could eat it at its leisure. That such a thing did not actually occur during the first few weeks of the experiment was because the feeding of Lot II was similar to that which it had previously received. The feeding of Lot III was also similar, but owing to the different conditions under which they were fed, Lot III being fed individually in stalls, Lot II gave the best results. But as Lot III became accustomed to its method of feeding, it did the best as was expected. The ninth week, however, the pigs of this lot contracted an illness similar to thumps more severe and earlier than Lot II, so that Lot II gained on it again. Pig No. 5 of Lot III seemed never to recover from this illness and for the last six weeks ate scarcely more than half the proper amount

of feed and gained practically nothing during the remainder of the experiment. This with the trouble in getting the other pigs of the lot to eat the proper amount of feed, allowed Lot II to gain further upon it and the two lots closed practically even. Lot II gained 839.5# at a cost of$.0447 per pound as against 840 pounds at a cost of $.0456 per pound for Lot III. So while the two lots finished practically together, it is believed that with better manipulation of the feeding, and without illness among the pigs, that Lot III would have produced the best results.

Individual Gains.

In Lot I the total gains were low with the exception of the one called No.7. This pig on a corn diet alone gained 104# in 112 days as compared with an average of 62.34 for the entire lot. He started, however, weighing 102# and had a good sized frame upon which to put fat. No.1 of the lot made a gain of only 38.5#, but in the beginning weighed only 59.5. Such feeding, the feed containing a large per cent of carbohydrates and a small per cent of protein, was wholly unsuited for such an animal.

The most remarkable pig in Lot II was No.6. This pig made the highest individual gain of any in the whole experiment. It made an increase of 160# or 1.41# per day for the whole time against a total average of 119.92. The pig making the smallest gain in this lot was No.5 which was next to No.6 in size at the beginning. The difference in weight between 5 and 6 at the beginning was only 13.5# while at the close it was 90#. This

was because No.6 consumed more feed than No.5. No.2 made the largest gains in Lot III. It weighed only 62# in the beginning but in the first eight weeks it gained 64# or 2# more than its weight. In the next six weeks it gained 2# daily on an average and for the period of 112 days made a total gain of 155# against an average of 120# for the lot. No.5 made the smallest gains in Lot III. This pig did all right up to the last six weeks but then failed to grow any further. For the whole time it gained only 68# which more than counterbalanced the good growth of No.2.

The individual gains of the various lots showed that individuality is an important factor in the feeding of hogs. Even though these pigs did look alike, and were similar in many ways at the beginning, there was a wide difference in the final outcome at the end of the experiment.

It is difficult to feed pigs properly. It seems that no two consume the same amount of feed in proportion to their live weight. They should develop proportionately, but other conditions enter in as they did in this case and they vary from each other.

Summary.

The results of the experiment show that the gains of Lots II and III were practically equal.

Lots II and III made greater and more consistent gains than did Lot I owing to the lack of variety and protein in the ration of Lot I.

The cost per pound gain, however, was less in Lot I owing to the cheapness of the feed.

Lot II made cheaper gains than did Lot III although the two were practically the same owing to illness of Lot III and the difficulty experienced in manipulating the feeding.

More dry feed and digestible nutrients were required to make a pound gain in Lot I than in Lot II and III owing to the lack of protein and variety in the ration of Lot I.

More dry feed and digestible nutrients were required to make a pound gain in Lot III than in Lot II for the same reason that Lot II made the cheaper gains.

The amount of dry feed and digestible nutrients in proportion to the live weight eaten by Lot III was greater than by Lot II and the least in Lot I.

The percentage of protein fed to live weight was less and the percentage of carbohydrates greater at the beginning and less at the close of the experiment in Lot I than in Lots II and III.